THURSDAY, SEPTEMBER 26, 1918.

APPLIED OPTICS.

Applied Optics: The Computation of Optical Systems. Being the "Handbuch der angewandten Optik" of Dr. Adolph Steinheil and Dr. Ernest Voit. Translated and edited by J. Weir French. Vol. i. Pp. xvii + 170. (London: Blackie and Son, Ltd., 1918.) Price 12*s.* 6*d.* net.

THE first volume of Steinheil's handbook appeared twenty-eight years ago, and the promised second and third volumes of the work never materialised, probably owing to the first meeting with insufficient appreciation. The book before us is a translation of the first half of Steinheil's first volume, and the fact that a prominent member of one of our foremost optical firms (Barr and Stroud) considered it worthy of this labour is eloquent proof of the truth of a statement by the late Prof. Silvanus P. Thompson in a noted outburst:—

"The simple reason of the badness of almost all recent British text-books of optics is that . . . they are written, not to teach the reader real optics, but to enable him to pass examinations set by non-optical examiners. The examination-curse lies over them all."

Steinheil's book certainly does not belong to this category; it is severely practical and almost crude in its empiricism. Scarcely any of the numerous formulæ given in the book are proved; the reader must either accept them and mechanically follow the scheme of the numerous numerical examples, or he must discover the proofs by his own effort. In the case of the complicated Seidel-formulæ for rays not proceeding in a plane containing the optical axis, a student unfamiliar with modern spherical trigonometry is not likely to succeed in this, and the proof of these formulæ, together with a clear explanation of the adopted method of astronomical computation with angles up to 360°, should certainly have been included in this first volume of the translation instead of being relegated to the promised second volume.

The Steinheil system of symbols is safe, but cumbersome, on account of the multitude of suffixes; the use of precisely the same symbols for paraxial and for marginal rays is, however, likely to cause confusion. The sign-conventions agree in all ordinary cases with those almost universally adopted by practical computers; the only defect in them is that all the signs are made to depend on the direction in which the light travels through the system; hence if the latter includes reflecting surfaces—a case expressly and necessarily included in the scheme—the signs of all the angles and intersection-lengths must be reversed before proceeding to the following surface. This complication is entirely avoided if the direction of the light is ignored and axial intercepts are given the sign usual in analytical geometry, and if the acute angles between the optical axis and the ray are called positive when corresponding with a clockwise turn.

The worst feature of the book is to be found in the definitions of the various aberrations, which are not only loose, but also frequently positively incorrect. Thus on p. 45 the important sine-condition is merely implied—and only in the form which it takes for systems applied to infinitely distant objects. The condition is correctly stated in its general form on p. 57, but the statement is immediately vitiated by the assertion that it is fulfilled "when the system has the same true focal length for any portion of the whole aperture"—*i.e.* when it is fulfilled for infinitely distant objects. With rare exceptions, in the case of certain systems having great thickness or wide separations, the exact contrary is true: A system fulfilling the sine-condition for objects at infinity does *not* fulfil it for objects at finite distances.

The worst confusion of this kind occurs in the case of distortion. On p. 44 this is correctly, although loosely, defined in its accepted meaning. Throughout the rest of the book the term is used for the defect universally known as coma, simply because the latter, by diffusing the rays over a certain area, necessarily causes most of them to fall away from the position of the ideal image-point. Steinheil thus ignores the fact that true distortion may exist in an otherwise perfect image, and that it causes a linear displacement of any image-point which is proportional to the third power of its distance from the optical axis, whilst the coma-displacement is proportional directly to the distance of an image-point from the optical axis, and also to the square of the aperture of the image-forming cone—which latter has no effect at all on true distortion.

On p. 56 coma is described as "spherical aberration out of the axis," which, again, is wrong; true spherical aberration may exist in oblique pencils independently of that on the optical axis, but it is a fifth-order aberration which has nothing to do with coma.

There are many other cases of a type similar to the above examples.

The book is beautifully printed on paper of extraordinary thickness, and the translator and editor may be congratulated on the excellence of his part of the work.

A. E. C.

THE MEGALITHIC CULTURE OF INDONESIA.

The Megalithic Culture of Indonesia. By W. J. Perry. Pp. xiii + 198. (Manchester: At the University Press; London: Longmans, Green, and Co., 1918.) Price 12*s.* 6*d.* net.

IN his presidential address to Section H (see NATURE, vol. lxxxvii., p. 356), at the meeting of the British Association at Portsmouth in 1911, Dr. Rivers explained how he had been led to reject the popular dogma of "spontaneous generation" in ethnology, which is wrongly claimed to be "evolution," and to realise the vast importance

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in the development of civilisation of the influence exerted by the contact of peoples and the diffusion of culture. When he recognised that the germs of the megalithic culture of Melanesia had been introduced from the west it was clear that the immediate problem for investigation was to determine whether the Malay Archipelago, the scattered islands of which convert the great waterway linking the Indian and Pacific Oceans into a sort of sieve, had preserved any records of the earliest of the cultural streams which must have been filtering through it for twenty-five centuries. He therefore recommended Mr. W. J. Perry (who had been sent by Dr. A. C. Haddon to seek his advice as to the choice of a subject for investigation in ethnology) to learn the Dutch language and to search the voluminous, though scattered, literature of Indonesian ethnology for any evidence of the easterly diffusion of megalithic culture.

The book before us is the first substantial instalment of the results of this investigation; and it is certain to become a landmark in the history of ethnology. For it represents a noteworthy advance in the process of introducing the true methods of exact science into a domain of knowledge which for fifty years has been rendered increasingly chaotic by the misuse of biological terms and the misunderstanding of psychology.

An incursion into this maze of confusion by a man fresh from the severe discipline of the Mathematical Tripos might be expected to produce surprising results—and this expectation is fully justified in Mr. Perry's book. For he has impartially collected all the available facts, and based his explanation of them on the evidence they provide, without attempting to force them into any ready-made scheme, such as Waitz, Bastian, and Tylor have constructed, or to evade the issues so raised by taking refuge behind the blessed phrases "animism," "totemism," "intertribal barter," "sympathetic magic," "similarity of the working of the human mind," or any of the other catchwords that the modern ethnologist has been taught to use as substitutes for inquiring into the real meaning of things.

Mr. Perry was able not only to realise Dr. Rivers's expectations by finding the megalithic culture-complex in Indonesia, but he has also made wholly unexpected discoveries of far-reaching importance to the student of human nature and for the interpretation of the history of civilisation of the whole world.

With quite exceptional skill and insight he has been able to discover a pathway through the amazing jungle of Indonesian customs and beliefs, and to arrive at certain general conclusions which are of fundamental importance.

The most striking of these generalisations is the recognition of the fact that the irregular distribution of megalithic monuments is explained by their association with the localities where ancient goldmines or pearl beds are found. This discovery made it plain that it was the search for special forms of wealth which attracted ancient miners and pearl-divers to certain places, and not to others, in Indonesia (and throughout the world). These immigrants introduced a distinctive group of customs and beliefs wherever they settled—not merely peculiar methods of burial, but also terraced cultivation and irrigation, a system of chieftainship and a priesthood, the belief in a sky-heaven, habits of warfare and head-hunting, and a host of other peculiar practices which will enable the investigator to determine whence the wanderers came and the dates of the diffusions of culture of which they were the bearers.

But the magnitude of Mr. Perry's achievement is not to be measured merely by his demonstration of the motives which prompted the spreading abroad of the elements of civilisation twenty-five centuries ago and his explanation of the geographical distribution of certain phases of culture. The searching analysis in his book reveals the fact that before the coming of the stone-using people the indigenous population of Indonesia was leading an unexpectedly simple and idyllic lif [illegible] ace and contentment singularly free from a [illegible] nent display of inventiveness. It sheds a new light upon the factors which determine material and intellectual progress and upon the meaning of civilisation.

The work of Dr. Rivers and Mr. Perry is transforming ethnology from an incoherent jumble of fairy tales into a real science.

G. ELLIOT SMITH.

WAR WORK OF THE BRITISH MEDICAL SERVICES.

British Medicine in the War, 1914–17. *Being Essays on Problems of Medicine, Surgery, and Pathology arising among the British Armed Forces engaged in this War, and the Manner of their Solution.* Collected out of the *British Medical Journal,* April–October, 1917. (London: British Medical Association, 1917.) Price 2*s.* 6*d.*

THIS reprint of collected papers from the *British Medical Journal* is of very great interest, demonstrating as it does the rapid progress made in the medical services of the Navy and Army during the war. Although the articles were published at various dates between April and October, 1917, the methods described in some instances prove less than a year later to be only of historical interest: conditions and disease problems are discussed which are no longer confronting the armies in the field. The editor's preface eloquently directs the reader's attention to these points, so that we never lose sight of the view that medicine and surgery in this war are not, and cannot be allowed to become, stationary. Used as a guide and handbook of practice in the field, this collection of articles would soon be found out of date, but, carefully read, one can trace clearly the landmarks on the road that has been traversed.

The medical departments of the Navy and Army have, fortunately, been characterised by broad-minded elasticity. Innovations have been wel-

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